

**REMARKS**

This Preliminary Amendment cancels the original claims, without prejudice, in the underlying PCT Application No. PCT/EP2004/011248. The Preliminary Amendment also adds new claims 8-14. The new claims conform the claims to U.S. Patent and Trademark Office rules and do not add new matter to the application.

In accordance with 37 C.F.R. § 1.125(b), the Substitute Specification (including the Abstract) contains no new matter. The amendments reflected in the Substitute Specification (including Abstract) are to conform the Specification and Abstract to United States Patent and Trademark Office rules or to correct informalities. As required by 37 C.F.R. §§ 1.121(b)(3)(ii) and 1.125(c), a Marked-Up Version of the Substitute Specification comparing the Specification of record and the Substitute Specification also accompanies this Preliminary Amendment. Approval and entry of the Substitute Specification (including Abstract) are respectfully requested.

The underlying PCT Application No. PCT/EP2004/011248 includes an International Search Report, dated April 4, 2005, a copy of which is submitted herewith.

Applicants assert that the subject matter of the present application is new, non-obvious, and useful. Prompt consideration and allowance of the application are respectfully requested.

Respectfully submitted,

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## ELECTRONIC CIRCUIT CONFIGURATION FOR CONNECTING AT LEAST ONE ACTIVE ROTARY SPEED SENSOR, ESPECIALLY IN COMMERCIAL VEHICLES

### Field Of The Invention

The present invention relates to an electronic circuit configuration for connecting at least one active rotary speed sensor of a vehicle via an assigned signal conditioning circuit to a control unit for further signal processing of the rotary speed signal.

### 5 Background Information

Rotary speed sensors of the type that is of interest here are used in vehicle technology to obtain one of the most important input variables for the electronic control of a vehicle. Thus, the conventional antilock brake systems (ABS), antislip controls (ARS) and vehicle stability control systems (FSR, ASMS) are forced to rely on permanent measurement and evaluation of 10 the rotary speed response of the individual vehicle wheels. The rotary speed signals of each individual vehicle wheel are recorded and transmitted via a sensor line to an electronic control unit, for the purpose of being evaluated.

Such an active rotary speed sensor is known from WO 95/International Published PCT Application No. 95 17680. The fixed part of the rotary speed sensor includes a 15 magnetoresistive sensor element having a permanent magnet that is used as booster magnet, and besides that has electronic circuit components for signal conditioning. An active rotary speed sensor requires a current supply. The output signal of the active rotary speed sensor is a binary current signal, which is composed of impressed currents of different amplitudes. The rotary speed information is located in the frequency or in the change between the two current 20 levels. Known rotary speed sensors of this type give rise to a square wave signal, whose frequency reproduces the measured rotary speed.

For the further processing of the information supplied by the active rotary speed sensor, a microcontroller is usually inserted, on whose input side the circuit for the signal conditioning is preconnected. The relatively cost-effective, active rotary speed sensors that are obtainable in 25 the passenger car field are not suitable for the recording of the rotary speed in the field of commercial vehicles. These rotary speed sensors could be damaged if they come into connection with the onboard voltage of 24 Volt of the commercial vehicle, since this type of

rotary speed sensor is designed only for maximum voltages of 12 Volt of the passenger vehicle electrical system.

Summary Of The Invention

It is therefore the object of the present invention to improve the electronic configuration of an active rotary speed sensor for the passenger vehicle field, at minimum increased expenditure, in such a way that it is usable in the commercial vehicle field.

The objective is achieved starting from an electronic circuit configuration according to the preamble of Claim 1 in conjunction with its distinguishing features. The subsequent dependent claims describe advantageous further refinements of the present invention.

- 10 The present invention includes the technical teaching that a normally closed switching element is inserted into the circuit for the current supply of the active rotary speed sensor, which is able to be switched into the open state via means for detecting a short circuit in sensor line A or B, in order to prevent an overvoltage that is damaging to the active rotary speed sensor.
- 15 The design approach according to the present invention thus describes an electronic circuit configuration for the protection of active rotary speed sensor, especially for installation in commercial vehicles having an onboard voltage of at least 24 Volt. Starting from circuits for signal conditioning, that are sufficiently well known in the related art, for active rotary speed sensors, these are to be broadened according to the present invention. All in all, one obtains an
- 20 electronic circuit configuration which protects in a simple way the cost-effective active rotary speed sensor, that is designed for use in passenger vehicles, from higher currents than the maximum currents permissible for the rotary speed sensor, from the 24 volt vehicle electrical system of the commercial vehicle. The circuit technology expenditure for implementing this measure is slight.
- 25 Preferably, the normally closed switching element of the circuit configuration is developed as a transistor, whose base terminal is activated by the means for the detection of a short circuit in sensor line A or B. The switching element according to the present invention may be implemented in a simple manner, in component technology, as a normal bipolar transistor. However, it is also possible to design the switching element as a type of FET transistor or as a
- 30 relay or in any other suitable manner.

- The means, according to the present invention, for detecting a higher voltage potential than the sensor operating voltage in sensor line A or B advantageously include an in parallel connected diode device which controls a transistor, via at least one Z diode as threshold value element, which, in turn, switches the previously mentioned switching element, that is also preferably developed as a transistor, into the open state. This component technology adaptation requires a minimum of electronic components, so that the manufacturing expenditure is correspondingly low. Alternatively to the preferably only Z diode as threshold value element, it is also conceivable to assign its own diode to each sensor line A or B in the signal path after the diode device connected in parallel.
- 10 Preferably, the active rotary speed sensor used according to the present invention is designed for a lower operating voltage than the electrical system voltage of the vehicle. For example, rotary speed sensors having an operating voltage of 12 volt are able to be used in a 24 volt vehicle electrical system of a commercial vehicle. Since active rotary speed sensors for 12 volt applications are cost-effectively available as mass-produced items, the electronic circuit
- 15 configuration according to the present invention may make these rotary speed sensors applicable for commercial vehicles.

The signal conditioning circuit for level adjustment between the active rotary speed sensor and the electronic control unit as evaluation circuit takes place via a fixed current limitation known per se, having a comparator postconnected in the signal path. Adapted to this, the electronic control unit is preferably developed as a microcontroller, to which the conditioned rotary speed signal of the active rotary speed sensor is supplied.

#### Brief Description Of the Drawing

~~Further measures improving the present invention are presented in detail below together with the description of a preferred exemplary embodiment of the invention with reference to the single figure.~~ The figure shows an electronic circuit configuration for connecting an active rotary speed sensor.

#### Detailed Description

An active rotary speed sensor 1 destined for a passenger vehicle is inserted into a 24 volt vehicle electrical system of a commercial vehicle. Two sensor lines A and B are outgoing from active rotary speed sensor 1. Because of the current via a resistor 2, a switching element 3 developed as a bipolar transistor is conductive, so that active rotary speed sensor 1 is in normal

operation. A fixed current limitation connected to ground produces a signal conditioning circuit 4 in this context, which is used for level equalization. Signal conditioning circuit 4 has a comparator 5 postconnected to it, whose output is connected to the input of a microcontroller as control unit 6. Control unit 6 is used for further signal processing of the rotary speed signal generated by active rotary speed sensor 1 within the vehicle which is not shown.

In the fault case, i.e when a higher potential occurs than the operating voltage in sensor lines A or B, a current flow is created through diode device 7 that is correspondingly connected in parallel, which is a component of additional means for detecting said fault case. A postconnected, common Z diode 8, which is used here as a type of threshold value element, becomes conducting counter to its forward direction when the voltage drop via the Z diode attains a specified boundary value. The specified boundary value corresponding to the component parameters corresponds to the occurrence of a fault case, that is, the situation in which a damaging overvoltage is created. Upon the exceeding of the boundary value, a current flows towards ground via a resistor 9. As a result, a transistor 10 is switched through which, in turn, switches normally closed switching element 3, that is also developed as a transistor, into the open state. Consequently, a damaging overvoltage is forestalled by active rotary speed sensor 1.

The present invention is not limited to the exemplary embodiment described above. Rather, modifications thereof are also conceivable, ~~which are covered by the extent of protection of the following claims~~. Thus it is possible, for example, instead of only one transistor 10, to use a plurality of driver stages for controlling the transistor used as switching element 3, or to use a similarly functioning component, when necessary. Instead of a Z diode that is common to both sensor lines A and B, a dedicated z diode for each sensor line may also be provided.

List of reference numerals

- 1 active rotary speed sensor
- 2 resistor
- 3 switching element
- 4 signal conditioning circuit
- 5 comparator
- 6 control unit
- 7 diode device
- 8 Z diode
- 9 resistor
- 10 transistor

Abstract Of The Disclosure

*An electronic circuit configuration for connecting an active rotary speed sensor.*